

# **APPARATUS FOR CONVERTING TO SIX-CHANNEL OUTPUTS FROM TWO-CHANNEL**

## **BACKGROUND OF THE INVENTION**

### **1. Field of the Invention**

5       The present invention relates to an audio apparatus and, more particularly, to an apparatus formed on a motherboard of computer for converting to six-channel outputs to two-channel.

### **2. Description of Related Art**

On a conventional all-in-one motherboard, there are provided three  
10 audio connectors, i.e., LINE\_OUT, LINE\_IN and MIC\_IN connectors, based on PC99 standard. The LINE\_OUT connector is able to provided a two-channel output. The LINE\_IN connector is coupled to an external microphone so that a user can input his/her voice therein. The MIC\_IN connector is coupled to a LINE\_OUT connector of a stereo via a cable so as  
15 to input sounds into the stereo. A six-channel stereo is comprised of a left speaker, a right speaker, a central speaker, a low-frequency-effect speaker, a surround left speaker, and a surround right speaker. However, only the LINE\_OUT connector on the motherboard is able to provide left channel and right channel outputs based on PC99 standard. Hence, there is still a  
20 limitation in outputting a six-channel effect on a motherboard complied with PC99 standard.

Therefore, it is desirable to provide a novel apparatus formed on a motherboard of computer for converting to six-channel outputs from two-channel in order to mitigate and/or obviate the aforementioned

problems.

## SUMMARY OF THE INVENTION

An object of the present invention is to provide an apparatus formed on a motherboard of computer complied with PC99 standard for converting to  
5 six-channel outputs from two-channel.

To achieve the object, there is provided an apparatus for converting to six-channel outputs from two-channel and using a MIC\_IN connector, a LINE\_IN connector, and a LINE\_OUT connector for outputting six-channel sound effect. The apparatus comprises: a coder/decoder  
10 (CODEC) for coding or decoding sound signals so as to output central channel signal, low-frequency-effect signal, surround left signal, surround right signal, left channel signal, and right channel signal, input microphone signal, LINE\_IN\_L and LINE\_IN\_R signals, and generate control signal; a MIC\_IN connector switch for switching the MIC\_IN connector as an input  
15 means or an output means based on the control signal; a first filter for coupling the central signal and the low-frequency-effect signal to the MIC\_IN connector; a second filter for coupling the microphone signal inputted by the MIC\_IN connector to the CODEC; a third filter for coupling LINE\_IN\_L and LINE\_IN\_R signals inputted by the LINE\_IN connector to  
20 the CODEC; and a resistor circuit for coupling the surround left signal and the surround right signal to the LINE\_IN connector for output via the third filter.

Other objects, advantages, and novel features of the invention will become more apparent from the detailed description when taken in

conjunction with the accompanying drawings.

### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of the apparatus for converting to six-channel outputs from two-channel according to the invention;

5        FIG. 2 is a circuit diagram of the apparatus for converting to six-channel outputs from two-channel according to the invention;

FIG. 3 is an equivalent circuit diagram of the present apparatus in normal operation; and

10        FIG. 4 is an equivalent circuit diagram of the present apparatus performing a six-channel output operation.

### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to FIG. 1, there is shown an apparatus for converting to six-channel output from two-channel in accordance with the invention. The apparatus comprises a coder/decoder (CODEC) 10, a MIC\_IN connector switch 20, a first filter 30, a second filter 40, a third filter 50, a resistor circuit 60, and a microphone bias circuit 70. The CODEC 10 is able to code or decode sound signals for output, and generate a control signal EAPD. The MIC\_IN connector switch 20 acts to convert signals sent from a MIC\_IN connector coupled to an external microphone into a central signal (CENOUT) and a low-frequency-effect signal (LFEOUT), respectively. LINE\_IN\_L and LINE\_IN\_R signals inputted from a LINE\_IN connector are converted into surround left signal (SUR\_OUT\_L) and surround right signal (SUR\_OUT\_R), respectively. Finally, left and front right signals are outputted from a LINE\_OUT connector.

With reference to FIG. 2, a circuit diagram of FIG. 1 is illustrated. As shown, the central signal CENOUT and the low-frequency-effect signal LFEOUT are outputted from digital-to-analog converters (DACs) 101 and 102 in the CODEC 10. Next, the central signal CENOUT and the  
5 low-frequency-effect signal LFEOUT are sent to the MIC\_IN connector for output via the first filter 30.

The CODEC 10 issues the control signal EAPD to control the MIC\_IN connector switch 20. The MIC\_IN connector switch 20 has a first switch 21 and a second switch 22. A microphone bias voltage (+5V<sub>CODEC</sub>) is  
10 applied to the first switch 21 via the microphone bias circuit 70, and is further applied to the MIC\_IN connector. Thus, a microphone can be suitably biased once coupled to the MIC\_IN connector. A microphone signal is sent to a second filter 40 via the second switch 22. A MIC\_IN output signal from the second filter 40 is sent to an analog-to-digital  
15 converter (ADC) 105 of the CODEC 10.

The surround left signal SUR\_OUT\_L and the surround right signal SUR\_OUT\_R are outputted from DACs 103 and 104 in the CODEC 10. Next, the surround left signal SUR\_OUT\_L and the surround right signal SUR\_OUT\_R are sent to a third filter 50 via the resistor circuit 60. Finally,  
20 the surround left signal SUR\_OUT\_L and the surround right signal SUR\_OUT\_R are sent to and then outputted from the LINE\_IN connector.

An external sound source is fed into the device via the LINE\_IN connector. In detail, sound signal is sent to a third filter 50 from the LINE\_IN connector. The output terminals LINE\_IN\_L and LINE\_IN\_R are

coupled to ADCs 106 and 107 of the CODEC 10, respectively.

With reference to FIG. 3 in conjunction with FIG. 2, a two-channel output of the device is illustrated. First, the CODEC 10 outputs a low control signal EAPD. Thus, the transistor Q4 of the first switch 21 is off.  
5 Voltage at a node A is high, thus turning on a transistor Q3 of the first switch 21. The microphone bias voltage +5V<sub>CODEC</sub> is applied to the MIC\_IN connector via the microphone bias circuit 70. Hence, an appropriate voltage may be applied to a microphone signal when the microphone is coupled to the MIC\_IN connector. Transistors Q1 and Q2 of the second switch 22 are  
10 both on since the control signal EAPD is low and a voltage at a node B is high. Next, the microphone signal is sent to the CODEC 10 via the second filter 40.

At this time, the ADCs 105, 106 and 107 are enabled by the CODEC 10. Once enabled, the ADCs 105, 106, and 107 are able to receive input signals.  
15 Also, the DACs 101, 102, 103, and 104 are off, i.e., outputs thereof are in a high impedance state. Further, the DACs 108 and 109 are enabled to output sound signals from the LINE\_OUT connector via filters. The equivalent circuit is shown in FIG. 3. As shown, the MIC\_IN, the LINE\_IN, and the LINE\_OUT connectors are complied with PC99 standard.

20 With reference to FIG. 4 in conjunction with FIG. 2, a six-channel output of the device is illustrated. First, the CODEC 10 outputs a high control signal EAPD. Thus, the transistor Q4 is turned on. Voltage at the node A is low, thus turning off the transistor Q3. The microphone bias voltage +5V<sub>CODEC</sub> is prohibited from applying to the MIC\_IN connector

via the microphone bias circuit 70 due to the transistor Q3 being off. Hence, it is possible of avoiding the interference from occurring on the central signal CENOUT. The transistors Q1 and Q2 are turned off since the control signal EAPD is high and voltage at the node B is low. Hence, the  
5 low-frequency-effect signal LFEOUT will not be fed into the CODEC 10 via the second filter 40.

At this time, the DACs 101, 102, 103, 104, 108, and 109 are enabled by the CODEC 10. Once enabled, the DACs 101, 102, 103, 104, 108, and 109 are able to output sound signals. Also, the ADCs 105, 106, and 107 are off;  
10 i.e., outputs thereof are in a high impedance state. The equivalent circuit is shown in FIG. 4. As shown, the apparatus provides a six-channel output.

In view of the foregoing, it is known that, with the present apparatus, a user can listen to a six-channel output from a motherboard complied with PC99 standard. Also, in the six-channel output mode, the surround left and  
15 right signals share the third filter with the LINE\_IN\_L and LINE\_IN\_R signals, so as to save the cost.

Although the present invention has been explained in relation to its preferred embodiment, it is to be understood that many other possible modifications and variations can be made without departing from the spirit  
20 and scope of the invention as hereinafter claimed.